

## Claims

- [c1] 1.A metal oxide alkylation catalyst precursor composition comprising a pore former and a catalyst reagent.
- [c2] 2.The catalyst precursor composition of claim 1 wherein the pore former is present in an amount of between 0.01 and 5 percent by weight based upon the total weight of the catalyst reagent.
- [c3] 3.The catalyst precursor composition of claim 1, wherein the catalyst reagent comprises a magnesium reagent, an iron reagent or a combination comprising one of the foregoing.
- [c4] 4.The catalyst precursor composition of claim 3, wherein the magnesium reagent comprises magnesium hydroxide, magnesium nitrate, magnesium carbonate, magnesium sulphate, magnesium acetate, or a combination comprising one of the foregoing.
- [c5] 5.The catalyst precursor composition of claim 3, wherein the iron reagent comprises ferric nitrate, ferric sulfate, ferric chloride, ferrous nitrate, ferrous sulfate, ferrous chloride, or a combination comprising one of the foregoing.
- [c6] 6.The catalyst precursor composition of claim 1 wherein the pore former is selected from the group consisting of waxes and polysaccharides.
- [c7] 7.The catalyst precursor composition of claim 6, wherein the pore former comprises paraffin wax, polyethylene wax, microcrystalline wax, montan wax, or a combination comprising one of the foregoing.
- [c8] 8.The catalyst precursor composition of claim 6, wherein the polysaccharide is selected from one or more of cellulose, carboxyl methyl cellulose, cellulose acetate, starch, and walnut powder.
- [c9] 9.The catalyst precursor composition of claim 1, wherein the pore former is selected from the group consisting of citric acid, polyethylene glycol, oxalic acid, and stearic acid.
- [c10] 10.The catalyst precursor composition of claim 1, wherein the pore former is

selected from paraffin, polyethylene and mixtures thereof.

- [c11] 11.A catalyst made from the catalyst precursor composition of Claim 1.
- [c12] 12.The catalyst as claimed in claim 11, wherein the metal oxide alkylation catalyst has a bimodal distribution of pores less than 400 Angstroms.
- [c13] 13.The catalyst as claimed in claim 12, wherein the bimodal distribution of pores has a first distribution of pores wherein the first distribution has an average pore diameter less than 100 angstroms and a second distribution of pores wherein the second distribution has an average diameter greater than 100 angstroms and less than 400 Angstroms.
- [c14] 14.A method for preparing a metal oxide alkylation catalyst comprising the steps of (a) combining a pore former with at least one catalyst reagent selected from the group consisting of magnesium reagents and iron reagents to form a catalyst precursor composition and (b) calcining the catalyst precursor composition to form a metal oxide alkylation catalyst wherein the metal oxide alkylation catalyst has pores with a diameter between 100 and 400 Angstroms.
- [c15] 15.The method of claim 14, wherein in step (a) the pore former is incorporated in an amount of between 0.01 and 5 percent by weight based upon the total weight of the catalyst reagent.
- [c16] 16.The method of claim 14, wherein the catalyst reagent is selected from at least one of magnesium reagents and iron reagents.
- [c17] 17.The method of claim 14, wherein the magnesium reagent is selected from magnesium hydroxide, magnesium nitrate, magnesium carbonate, magnesium sulphate and magnesium acetate.
- [c18] 18.The method of claim 14, wherein the iron reagent is selected from ferric nitrate, ferric sulfate, ferric chloride, ferrous nitrate, ferrous sulfate and ferrous chloride.
- [c19] 19.The method of claim 14, wherein the pore former is selected from the group consisting of waxes and polysaccharides.

- [c20] 20.The method of claim 19, wherein the wax is selected from one or more of paraffin wax, polyethylene wax, microcrystalline wax, and montan wax.
- [c21] 21.The method of claim 19, wherein the polysaccharide is selected from one or more of cellulose, carboxyl methyl cellulose, cellulose acetate, starch, and walnut powder.
- [c22] 22.The method of claim 19, wherein the pore former is selected from one or more of citric acid, polyethylene glycol, oxalic acid, and stearic acid.
- [c23] 23.The method of claim 14, wherein the pore former is selected from paraffin, polyethylene and mixtures thereof.
- [c24] 24.The method of claim 14, wherein the pore former is present in an amount effective to result in pores having a diameter between 100 and 200 angstroms after the catalyst precursor composition has been subjected to calcination.
- [c25] 25.The method of claim 14, wherein the calcination is done under a flow of gas with a weight hourly space velocity of between about 0.01 to 0.25.
- [c26] 26.The method of claim 25, wherein the gas is selected from oxygen, nitrogen, air and mixtures thereof.
- [c27] 27.The method of claim 14, wherein the calcination is effected at a temperature between 350 and 600 ° C.
- [c28] 28.The method of claim 14, wherein the metal oxide alkylation catalyst has a bimodal distribution of pores less than 400 Angstroms.
- [c29] 29.The method of claim 14, wherein the bimodal distribution of pores has a first distribution of pores wherein the first distribution has an average pore diameter less than 100 angstroms and a second distribution of pores wherein the second distribution has an average diameter greater than 100 angstroms and less than 400 Angstroms.
- [c30] 30.A method for alkylating a phenol species to produce an alkylated phenol species, in which there is used a metal oxide catalyst made from a metal oxide alkylation catalyst precursor composition comprising a pore former and a

catalyst reagent.

- [c31] 31.The method of claim 30, wherein the alkylated phenol species is 2,6-dimethylphenol.
- [c32] 32.The method of claim 30, wherein the metal oxide catalyst comprises magnesium oxide, iron oxide or a combination comprising one of the foregoing.
- [c33] 33.The method of claim 30, wherein the metal oxide alkylation catalyst has a bimodal distribution of pores less than 400 Angstroms.
- [c34] 34.The method of claim 33, wherein the bimodal distribution of pores has a first distribution of pores wherein the first distribution has an average pore diameter less than 100 angstroms and a second distribution of pores wherein the second distribution has an average diameter greater than 100 angstroms and less than 400 Angstroms.